

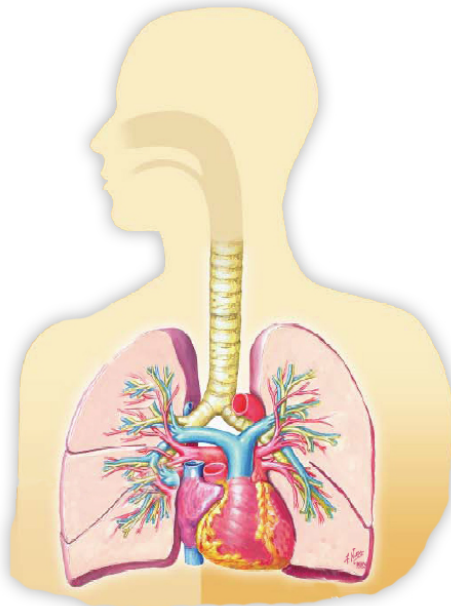
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## Health Effects



This page provides general information on the effects of air pollution on human health.

To get the latest up-to-date air quality conditions and forecasts for your area, click [here](#).

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Criteria Air Pollutants

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Premature Mortality Risk Attributable to PM2.5

#### Links

Health Effects of Particulate Matter and Ozone Air Pollution, January 2004

ARB Fact Sheet: Air Pollution & Health

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ARB Fact Sheet: Air Pollution Sources, Effects and Control CARB

Toxic Air Pollutants EPA

What Are the Six Common Air Pollutants? EPA

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## CRITERIA AIR POLLUTANTS

| <u>Pollutant</u>                                                                                                                                                                                                                   | <u>Symbol</u> | <u>Major Man-Made Sources</u>                                                                                                                                                                                                                                                                         | <u>Human Health &amp; Welfare Effects</u>                                                                                                                                                                                                                                                                                                                                                      | <u>Control Methods</u>                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Particulate Matter</b> Airborne solid particle and liquid particles Grouped into 2 categories:</p> <p>“Coarse Particles” from 2.5 to 10 microns in diameter</p> <p>“Fine Particles” smaller than 2.5 microns in diameter</p> | PM            | Power plants, steel mills, chemical plants, unpaved roads and parking lots, wood-burning stoves and fireplaces, automobiles and others.                                                                                                                                                               | Can get deep into your lungs or even enter your blood stream, and cause serious health problems; Increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing; aggravated asthma; development of chronic bronchitis; irregular heartbeat; nonfatal heart attacks; and premature death in people with heart or lung disease. Impairs visibility (haze). | Pollution control equipment and reduction of fuel combustion                                                                                                                                                      |
| <p><b>Ozone (Smog)</b> A colorless or bluish gas</p>                                                                                                                                                                               |               | Formed by a chemical reaction between volatile organic compounds (VOC) and nitrous oxides (NO <sub>x</sub> ) in the presence of sunlight. Motor vehicle exhaust industrial emissions, gasoline storage and transport, solvents, paints and landfills.                                                 | Irritates and causes inflammation of the mucous membranes and lung airways; causes wheezing, coughing and pain when inhaling deeply; decreases lung capacity; aggravates lung and heart problems. Damages plants; reduces crop yield. Damages rubber, some textiles and dyes.                                                                                                                  | Pollution control equipment; reducing NO <sub>x</sub> emissions from power plants and industrial combustion sources; introducing low-emission cars and trucks; using “cleaner” gasoline; use of low-VOC solvents. |
| <p><b>Sulfur Dioxide</b> A colorless, nonflammable gas</p>                                                                                                                                                                         |               | Formed when fuel containing sulfur, such as coal and oil, is burned; when gasoline is extracted from oil; or when metal is extracted from ore. Examples are petroleum refineries, cement manufacturing, metal processing facilities, locomotives, large ships, and fuel combustion in diesel engines. | Respiratory irritant. Aggravates lung and heart problems. In the presence of moisture and oxygen, sulfur dioxide converts to sulfuric acid which can damage marble, iron and steel; damage crops and natural vegetation. Impairs visibility. Precursor to acid rain.                                                                                                                           | Use of low-sulfur fuels, energy conservation (reduces power plant emissions), and pollution control equipment.                                                                                                    |

**Carbon Monoxide** An odorless, colorless gas.

Formed when carbon in fuel is not burned completely; a component of motor vehicle exhaust.

Reduces the ability of blood to deliver oxygen to vital tissues, effecting the cardiovascular and nervous system. Impairs vision, causes dizziness, and can lead to unconsciousness or death.

Ultra Low Sulfur Diesel is being phased in during 2006 and will be mandatory in 2007.

Transportation planning, vehicle emission testing and reduction, efficient combustion techniques, and energy conservation.

**Nitrogen Dioxide** A reddish-brown gas

Fuel combustion in motor vehicles and industrial sources. Motor vehicles; electric utilities, and other sources that burn fuel.

Respiratory irritant; aggravates lung and heart problems. Precursor to ozone and acid rain. Contributes to global warming, and nutrient overloading which deteriorates water quality. Causes brown discoloration of the atmosphere.

Exhaust gas recirculation in motor vehicles; reduction of combustion temperatures in industrial sources; energy conservation pollution control equipment.

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## AIR QUALITY GUIDE FOR OZONE

| Air Quality                    | Air Quality Index | Protect Your Health                                                                                                                                                                                   |
|--------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Good                           | 0-50              | No health impacts are expected when air quality is in this range.                                                                                                                                     |
| Moderate                       | 51-100            | Unusually sensitive people should consider limiting prolonged outdoor exertion.                                                                                                                       |
| Unhealthy for Sensitive Groups | 101-150           | Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion.                                                                             |
| Unhealthy                      | 151-200           | Active children and adults, and people with respiratory disease, such as asthma, should avoid prolonged outdoor exertion; everyone else, especially children should limit prolonged outdoor exertion. |

Very Unhealthy (Alert)

201-300

Active children and adults, and people with respiratory disease, such as asthma, should avoid all outdoor exertion; everyone else, especially children, should limit outdoor exertion.

Hazardous

301-500

Everyone should avoid all physical activity outdoors.

### **What is Ozone?**

Ozone is a gas composed of three atoms of oxygen. Ozone occurs both in the Earth's upper atmosphere and at ground level.

### **What are the health effects and who is most at risk?**

- Roughly one out of every three people in the United States is at a higher risk of experiencing problems from ground-level ozone.
- One group at high risk is active children because they often spend a large part of the summer playing outdoors.
- People of all ages who are active outdoors are at increased risk because, during physical activity, ozone penetrates deeper into the parts of the lungs that are more vulnerable to injury.
- People with respiratory diseases, including asthma, that make their lungs more vulnerable to ozone may experience health effects earlier and at lower ozone levels than other people.
- Though scientists don't yet know why, some healthy people are unusually sensitive to ozone. They may experience health effects at more moderate levels of outdoor exertion or at lower ozone levels than the average person.
- Ozone can irritate the respiratory system, causing coughing, throat irritation, and/or an uncomfortable sensation in the chest.
- Ozone can reduce lung function and make it more difficult to breathe deeply and vigorously. Breathing may become more rapid and shallow than normal. This may limit a person's ability to engage in vigorous activities.
- Ozone can aggravate asthma. When ozone levels are high, more people with asthma have attacks that require a doctor's attention or use of medication. One reason this happens is that ozone makes people more sensitive to allergens such as pets, pollen, and dust mites, which are common triggers of asthma attacks.
- Ozone can increase susceptibility to respiratory infections.
- Ozone can inflame and damage the lining of the lungs. Within a few days, the damaged cells are shed and replaced-much like the skin peels after a sunburn. Studies suggest that if this type of inflammation happens repeatedly over a long time period (months, years, a lifetime), lung tissue may become permanently scarred, resulting in permanent loss of lung function and a lower quality of life.

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## AIR QUALITY GUIDE FOR PARTICLE POLLUTION

Air Quality

Air Quality Index

Protect Your Health

Good

0-50

No health impacts are expected when air quality is in this range.

Moderate

51-100

Unusually sensitive people should consider reducing prolonged or heavy exertion.

|                                |         |                                                                                                                                                                              |
|--------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unhealthy for Sensitive Groups | 101-150 | People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.                                                                     |
| Unhealthy                      | 151-200 | People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.             |
| Very Unhealthy (Alert)         | 201-300 | People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.           |
| Hazardous                      | 301-500 | People with heart or lung disease, older adults, and children should remain indoors and keep activity levels low. Everyone else should avoid all physical activity outdoors. |

### **What is Particle Pollution?**

Particle pollution (also known as “particulate matter”) in the air includes a mixture of solids and liquid droplets. Some particles are emitted directly; others are formed in the atmosphere when other pollutants react. Particles come in a wide range of sizes. Those less than 10 micrometers in diameter are so small that they can get into the lungs, potentially causing serious health problems. Ten micrometers is smaller than the width of a single human hair.

### **What are the health effects and who is most at risk?**

Particles smaller than 10 micrometers in diameter can cause or aggravate a number of health problems and have been linked with illnesses and deaths from heart or lung diseases. These effects have been associated with both short-term exposures (usually over a 24-hour period, but possibly as short as one hour) and long-term exposures (years).

- Sensitive groups for particle pollution include people with heart or lung disease, older adults (who may have undiagnosed heart or lung disease), and children.
- People with heart or lung diseases—such as congestive heart failure, coronary artery disease, asthma, or chronic obstructive pulmonary disease—and older adults are more likely to visit emergency rooms, be admitted to hospitals, or in some cases, even die. When exposed to particle pollution, people with heart disease may experience chest pain, palpitations, shortness of breath, and fatigue. Particle pollution has also been associated with cardiac arrhythmias and heart attacks.
- When exposed to particles, people with existing lung disease may not be able to breathe as deeply or vigorously as they normally would. They may experience symptoms such as coughing and shortness of breath. Healthy people also may experience these effects, although they are unlikely to experience more serious effects.
- Particle pollution also can increase susceptibility to respiratory infections and can aggravate existing respiratory diseases, such as asthma and chronic bronchitis, causing more use of medication and more doctor visits.

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## AIR QUALITY GUIDE FOR CARBON MONOXIDE (CO)

|                                |               |                                                                                                                                                        |
|--------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Good                           | 0-50          | None.                                                                                                                                                  |
| <b>Moderate</b>                | <b>51-100</b> | <b>None.</b>                                                                                                                                           |
| Unhealthy for Sensitive Groups | 101-150       | People with heart disease, such as angina, should reduce heavy exertion and avoid sources of CO, such as heavy traffic                                 |
| Unhealthy                      | 151-200       | People with heart disease, such as angina, should reduce moderate exertion and avoid sources of CO, such as heavy traffic.                             |
| Very Unhealthy (Alert)         | 201-300       | People with heart disease, such as angina, should avoid exertion and sources of CO, such as heavy traffic.                                             |
| Hazardous                      | 301-500       | People with heart disease, such as angina, should avoid exertion and sources of CO, such as heavy traffic. Everyone else should reduce heavy exertion. |

### **What is Carbon Monoxide?**

Carbon monoxide (CO) is an odorless, colorless gas. It forms when the carbon in fuels does not completely burn. Vehicle exhaust contributes roughly 60 percent of all carbon monoxide emissions nationwide, and up to 95 percent in cities. Other sources include fuel combustion in industrial processes and natural sources such as wildfires. Carbon monoxide levels typically are highest during cold weather, because cold temperatures make combustion less complete and cause inversions that trap pollutants close to the ground.

### **What are the health effects and who is most at risk?**

Carbon monoxide enters the bloodstream through the lungs and binds to hemoglobin, the substance in blood that carries oxygen to cells. It actually reduces the amount of oxygen reaching the body's organs and tissues.

- People with cardiovascular disease, such as angina, are most at risk. They may experience chest pain and other cardiovascular symptoms if they are exposed to carbon monoxide, particularly while exercising.
- People with marginal or compromised cardiovascular and respiratory systems (for example, individuals with congestive heart failure, cerebrovascular disease, anemia, chronic obstructive lung disease), and possibly young infants and fetuses, also may be at greater risk from carbon monoxide pollution.
- In healthy individuals, exposure to higher levels of carbon monoxide can affect mental alertness and vision.

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## AIR QUALITY GUIDE FOR SULFUR DIOXIDE (SO<sub>2</sub>)

|             |                   |                     |
|-------------|-------------------|---------------------|
| Air Quality | Air Quality Index | Protect Your Health |
| Good        | 0-50              | None.               |

|                                |         |                                                                                                                                           |
|--------------------------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Moderate                       | 51-100  | None.                                                                                                                                     |
| Unhealthy for Sensitive Groups | 101-150 | People with asthma should consider reducing exertion outdoors.                                                                            |
| Unhealthy                      | 151-200 | Children, asthmatics, and people with heart or lung disease should reduce exertion outdoors.                                              |
| Very Unhealthy (Alert)         | 201-300 | Children, asthmatics, and people with heart or lung disease should avoid outdoor exertion. Everyone else should reduce exertion outdoors. |
| Hazardous                      | 301-500 | Children, asthmatics, and people with heart or lung disease should remain indoors. Everyone else should avoid exertion outdoors.          |

### **What is Sulfur Dioxide?**

Sulfur dioxide (SO<sub>2</sub>), a colorless, reactive gas, is produced when sulfur-containing fuels such as coal and oil are burned. Major sources include power plants and industrial boilers. Generally, the highest levels of sulfur dioxide are near large industrial complexes.

### **What are the health effects and who is most at risk?**

Sulfur dioxide is an irritant gas that is removed by the nasal passages. Moderate activity levels that trigger mouth breathing, such as a brisk walk, are needed for sulfur dioxide to cause health effects.

- People with asthma who are physically active outdoors are most likely to experience the health effects of sulfur dioxide. The main effect, even with brief exposure, is a narrowing of the airways (called bronchoconstriction). This may cause wheezing, chest tightness, and shortness of breath. Symptoms increase as sulfur dioxide levels and/or breathing rates increase. When exposure to sulfur dioxide ceases, lung function typically returns to normal within an hour.
- At very high levels, sulfur dioxide may cause wheezing, chest tightness, and shortness of breath even in healthy people who do not have asthma.
- Long-term exposure to sulfur dioxide can cause respiratory illness, alter the lung's defense mechanisms, and aggravate existing cardiovascular disease. People with cardiovascular disease or chronic lung disease, as well as children and older adults, may be most susceptible to these effects.

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### **What is Lead?**

Lead is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions have historically been motor vehicles (such as cars and trucks) and industrial sources. Due to the phase out of leaded gasoline, metals processing is the major source of lead emissions to the air today. The highest levels of lead in air are generally found near lead smelters. Other stationary sources are waste incinerators, utilities, and lead-acid battery manufacturers.



**What are the health effects and who is most at risk?**

Lead is:

- particularly affects young children and infants
- is still found at high levels in urban and industrial areas
- deposits on soil and water and harms animals and fish

Although overall blood lead levels have decreased since 1976, infants and young children still have the highest blood lead levels. Children and others can be exposed to lead not only through the air, but also through accidentally or intentionally eating soil or paint chips, as well as food or water contaminated with lead.

- People, animals, and fish are mainly exposed to lead by breathing and ingesting it in food, water, soil, or dust. Lead accumulates in the blood, bones, muscles, and fat. Infants and young children are especially sensitive to even low levels of lead.
- Lead causes damage to the kidneys, liver, brain and nerves, and other organs. Exposure to lead may also lead to osteoporosis (brittle bone disease) and reproductive disorders.
- Excessive exposure to lead causes seizures, mental retardation, behavioral disorders, memory problems, and mood changes. Low levels of lead damage the brain and nerves in fetuses and young children, resulting in learning deficits and lowered IQ.
- Lead exposure causes high blood pressure and increases heart disease, especially in men. Lead exposure may also lead to anemia, or *weak blood*.
- Wild and domestic animals can ingest lead while grazing. They experience the same kind of effects as people who are exposed to lead. Low concentrations of lead can slow down vegetation growth near industrial facilities.
- Lead can enter water systems through runoff and from sewage and industrial waste streams. Elevated levels of lead in the water can cause reproductive damage in some aquatic life and cause blood and neurological changes in fish and other animals that live there.

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**What is Nitrogen Oxide?**

Nitrogen Oxide, or NO<sub>x</sub>, is the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Many of the nitrogen oxides are colorless and odorless. However, one common pollutant, nitrogen dioxide (NO<sub>2</sub>) along with particles in the air can often be seen as a reddish-brown layer over many urban areas.

Nitrogen oxides form when fuel is burned at high temperatures, as in a combustion process. The primary manmade sources of NO<sub>x</sub> are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels. NO<sub>x</sub> can also be formed naturally. **NO<sub>x</sub> Emission in California — 2005**

**What are the health effects and who is most at risk?**

Nitrogen Oxide causes a wide variety of health and environmental impacts because of various compounds and derivatives in the family of nitrogen oxides, including nitrogen dioxide, nitric acid, nitrous oxide, nitrates, and nitric oxide.

- Ground-level Ozone (Smog) – is formed when NO<sub>x</sub> and volatile organic compounds (VOCs) react in the presence of sunlight. Children, people with lung diseases such as asthma, and people who work or exercise outside are susceptible to adverse effects such as damage to lung tissue and reduction in lung function. Ozone can be transported by wind currents and cause health impacts far from original sources. Millions of Americans live in areas that do not meet the health standards for ozone. Other impacts from ozone include damaged vegetation and reduced crop yields
- Acid Rain – NO<sub>x</sub> and sulfur dioxide react with other substances in the air to form acids which fall to earth as rain, fog, snow or dry particles. Some may be carried by wind for hundreds of miles. Acid rain damages; causes deterioration of cars, buildings and historical monuments; and causes lakes and streams to become acidic and unsuitable for many fish.
- Particles – NO<sub>x</sub> reacts with ammonia, moisture, and other compounds to form nitric acid and related particles. Human health concerns include effects on breathing and the respiratory system, damage to lung tissue, and premature death. Small particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease such as emphysema and bronchitis, and aggravate existing heart disease.
- Water Quality Deterioration – Increased nitrogen loading in water bodies, particularly coastal estuaries, upsets the chemical balance of nutrients used by aquatic plants and animals. Additional nitrogen accelerates “eutrophication,” which leads to oxygen depletion and reduces fish and shellfish populations. NO<sub>x</sub> emissions in the air are one of the largest sources of nitrogen pollution in the Chesapeake Bay.
- Global Warming – One member of the NO<sub>x</sub>, nitrous oxide, is a greenhouse gas. It accumulates in the atmosphere with other greenhouse gasses causing a gradual rise in the earth’s temperature. This will lead to increased risks to human health, a rise in the sea level, and other adverse changes to plant and animal habitat.
- Toxic Chemicals – In the air, NO<sub>x</sub> reacts readily with common organic chemicals and even ozone, to form a wide variety of toxic products, some of which may cause biological mutations. Examples of these chemicals include the nitrate radical, nitroarenes, and nitrosamines.
- Visibility Impairment – Nitrate particles and nitrogen dioxide can block the transmission of light, reducing visibility in urban areas and on a regional scale in our national parks.

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